HARDWARE REFERENCE MANUAL

MACRO CPU BOARD

HRM for UMAC MACRO & MACRO Stack

4Ax-602804-xHxx

January 29, 2003

DELTA TAU
Data Systems, Inc.
NEW IDEAS IN MOTION ...

Single Source Machine Control *Power // Flexibility // Ease of Use*
21314 Lassen Street Chatsworth, CA 91311 // Tel. (818) 998-2095 Fax. (818) 998-7807 // www.deltatau.com

CONTENTS

INTRODUCTION 1

3U Product Configurations (General Description) 2

MACRO CPU Specifications 4
Physical Specifications 4
Electrical Specifications 4

3U MACRO-CPU CONFIGURATION 5

3U MACRO CPU BOARD HARDWARE SETUP 7

3U MACRO CPU Board Jumper & Switch Setup 7

MACRO CPU Board Connections 8

3U MACRO-CPU JUMPER AND SWITCH CONFIGURATIONS 11

3U MACRO-CPU Card Layout 11
E1: Watchdog Timer Disable 12
E2: CPU Mode Operation 12
E3: Serial Port Baud Rate 12
E4: Power Supply-Loss Control (±15Vdc Supply Monitor) 12
E5: MACRO Received Signal Detect/Bypass Mode (rev -105 and 106 only). Does not exist on rev 107 and later models. 13
E40: MACRO Input (Fiber/Wired) Selector 13
JP3: MACRO Loop back Test Select For Copper Only (rev -104 and earlier) 13
JP4: Reserved for Future Use 13
JP5-JP6: MACRO Copper EQ Select (rev -104 and earlier) 14

Switch Configurations 15
SW1: MACRO Slave Node Configure 15
SW2: MACRO Master Number Select 15

Connector Summary 16

MACRO STATION CHARACTER DISPLAY 17

HARDWARE RE-INITIALIZATION 18

FIRMWARE UPDATES 20

3U MACRO-CPU BOARD CONNECTOR PIN-OUTS 22
J6: (JTHW) Multiplexer Port Connector 22
J7: (JRS232) Serial Port Connector 24
J14, J17: MACRO COPPER I/O (OPT C) 25
P1: UBUS Interface Connector 26
TB1: (JPWR) 4-Pin Terminal Block 27
U73: MACRO Fiber Optic Connector (OPT A) 27

U MACRO-CPU HARDWARE MEMORY MAP 28

ACCESSORIES 30

INTRODUCTION

The 3U MACRO-CPU board is the processor and MACRO interface board that is used in a 3U MACRO Station (in either UMAC MACRO or MACRO Stack configuration).

Note

There are 3 documents that describe the operation of Delta Tau Data Systems Inc. 3U MACRO Station products:

- UMAC System Manual (General Product Overview)
- 3U MACRO Station User's Manual
- 3U MACRO Station Software Reference

This manual describes the interfaces and physical hardware that is used on the 3U MACRO CPU.

The UMAC MACRO and the MACRO Stack provide a remote interface for encoders, flags, direct-PWM digital drives, analog drives, stepper drives, analog I/O, and digital I/O for Delta Tau Data's PMAC products that have a MACRO interface.

The UMAC MACRO and MACRO Stack configurations communicate with PMAC2 Ultralites or Turbo PMAC2 Ultralites solely through the MACRO ring, interfacing to standard drives, encoders, flags, and I/O through on-board connectors. This MACRO Station integrated packaging and connectivity strategy provides revolutionary flexibility and ease of use.

A 3U MACRO Station consists of a set of "3U" format Euro-cards (100 x 160 mm) that can be assembled in a variety of configurations. When used in the rack configuration, connected through a backplane bus, the backplane is UBUS format, designed by Delta Tau Data Systems Inc. for motion control and I/O interfaces.

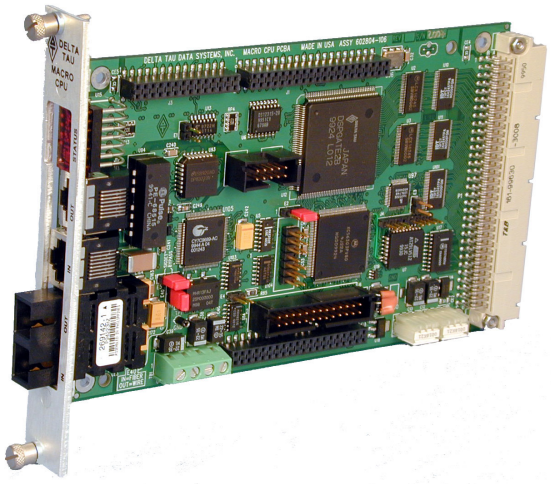
When using the fiber optic MACRO interface, the 3U MACRO Station can be up to 3 kilometers (2 miles) away from the PMAC2 controller or any other station on the ring. When using the RJ-45 copper electrical interface, it can be up to 100 meters (~330 feet) away.

The 3U MACRO Station allows PMAC2 MACRO controllers to control servo axes and I/O just as if they were directly connected to the PMAC2, even though they may be a great distance away. The only interface needed from the PMAC2 is the electrically isolated MACRO ring.

Typically, a PMAC2 "Ultralite" board, one without any of its own servo interface circuitry, is used with the MACRO Station to provide the most cost-effective solution.

3U MACRO-CPU Board (3A0-602804-10x):

- 80MHz DSP56303 CPU
- 512k x 8 flash memory for user backup & firmware
- Latest released firmware version
- RS-232 serial interface for setup and debugging
- Stack connectors for servo and I/O accessory boards
- UBUS connector for backplane connection to servo and I/O accessory boards
- JTHW multiplexed I/O port with 26-pin IDC header



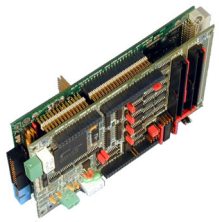
The 3U MACRO Station can be configured in either of two fundamental assemblies – "UMAC MACRO" and "MACRO Stack":

- **UMAC MACRO** – In this configuration (once called "Pack") the 3U-format boards are put together to communicate through a backplane bus called the UBUS. All boards are installed in a Euro-card rack. In this configuration, all 3U-format boards or modules can be installed or withdrawn from the pack individually, providing ease of installation, debugging, and repair.

The photo at the upper right shows a UMAC rack with power supply and I/O boards that are connected through a backplane. This system allows for an easier integration of the 3U MACRO-CPU for larger (up to 8 axes) applications.

UMAC MACRO Station Configuration

- **MACRO Stack** – In the Stack configuration the 3U-format boards are put together as a stack of piggyback boards, (right, below). This configuration is ideal for compact, cost-sensitive embedded applications.



4 Axis Stack Configuration

Note:

The Stack boards and related breakout boards can be installed in a Euro-card rack, creating a hybrid "stack/pack" configuration. This requires a special backplane configuration that makes removing stack boards difficult.

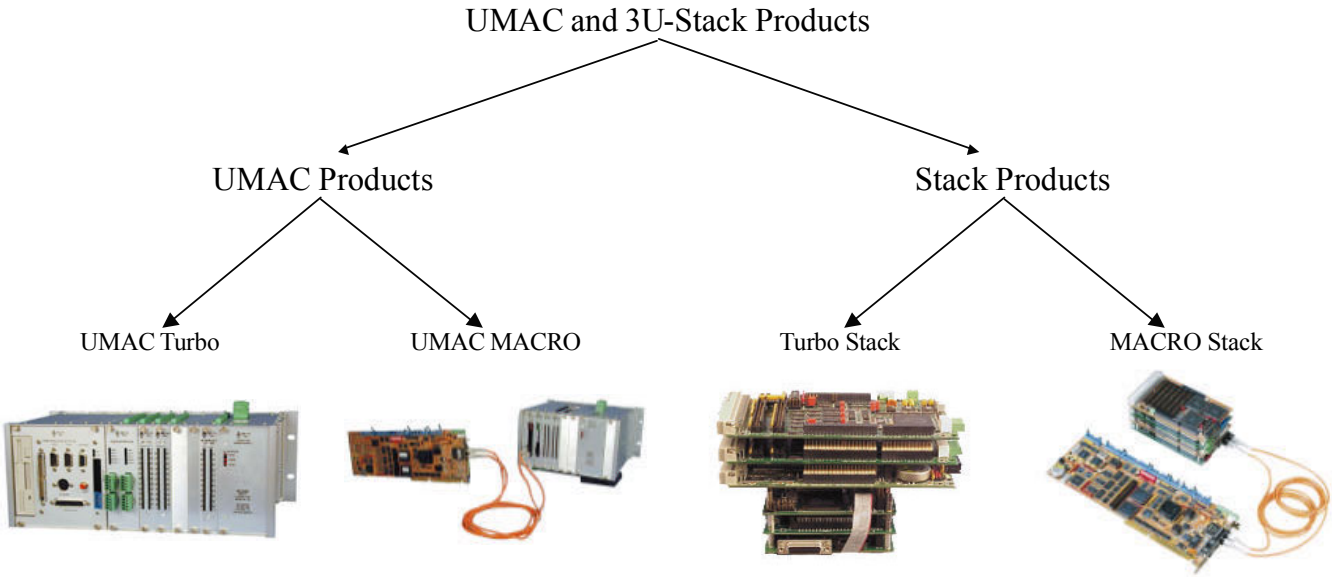
This hybrid configuration is now recommended for existing "legacy" systems only.

3U Product Configurations (General Description)

Assemblies of 3U-format boards can be made with either of two CPU processor boards – a 3U MACRO-CPU board, or a 3U Turbo PMAC2 CPU board. Most other 3U-format boards, labeled “Accessory” boards, can be used with either CPU board.

- When the 3U MACRO-CPU board is used, the resulting assemblies are called “UMAC MACRO” or "3U MACRO Stack."
- When the 3U Turbo PMAC2 CPU board is used, the resulting assemblies are called “UMAC Turbo” or "Turbo Stack."

Refer to the "UMAC & 3U Stack Products Selection Guide" for more detailed descriptions of how the rack and stack products are integrated.



The UMAC Turbo is composed of a 3U-format Turbo PMAC2 CPU board and a set of accessory boards in 3U-format, all plugged in a common UBUS backplane and installed inside a 3U format rack. A PC/104 computer and several optional communication accessories (including all of the major FieldBuses, MACRO and Ethernet) can be installed inside the UMAC system providing convenient flexibility and virtually unlimited expandability.

The UMAC MACRO is composed of a MACRO Interface/CPU board and a set of accessory boards in 3U-format, all plugged in a common UBUS backplane and installed inside a 3U format rack. The UMAC MACRO must receive commands from an external MACRO compatible device like a PMAC2 Ultralite or a UMAC Turbo system. The UMAC MACRO does not support a PC/104 or communication accessories and it is preferred for distributed control over a MACRO ring connection.

The Turbo stack is composed of a 3U-format Turbo PMAC2 CPU board and a set of accessory boards in 3U-format plugged to it in a stack configuration. The Turbo stack configuration is less expensive than the UMAC Turbo system but it is limited to eight axes of motion control versus 32 axes on a UMAC Turbo system. The Turbo Stack is selected over a UMAC Turbo system because is more compact, allowing its installation inside already existing cabinets with some space limitations.

The MACRO stack is composed of a MACRO Interface/CPU board and a set of accessory boards in 3U-format plugged to it in a stack configuration. The UMAC MACRO must receive commands from an external MACRO compatible device like a PMAC2 Ultralite or a UMAC Turbo system. The MACRO Stack is selected over a UMAC MACRO system because it is more compact, allowing its installation inside already existing cabinets with some space limitations.

MACRO CPU Specifications

Physical Specifications

Size: 33.5cm x 9.9cm x 3.8cm (13.2" x 3.9" x 1.4")

Weight: ½ lb.

Temperature

Operating: 0°C to 60°C (32°)F to 140°F)

Storage: 12°C to 82°C (10°F to 180°F)

Humidity: 10% to 95%, noncondensing

Electrical Specifications

Power: 1.5A @ +5V (±5%) (7.5W) Pertains to 8-channel configuration, with a typical load of encoders.

3U MACRO-CPU CONFIGURATION

The purchase of the 3U MACRO CPU board provides a 3U-format (100mm x 160mm) board with a DSP processor, MACRO ring circuitry, "piggyback" connectors onto which "stack" accessory boards can be mounted, and a backplane connector through which other 3U-format boards can be connected by means of a "UBUS" passive-backplane board.

The MACRO CPU board went through an extensive redesign in the –105 revision, because key components on the –104 and older revisions became obsolete. Both the older and the newer versions are described in this manual. The only system change required is a slight change in the DIP-switch addressing of ACC-24E2x and ACC-51E backplane axis boards when using the new MACRO CPU boards.

Note

It is recommended that only the new MACRO CPU boards, which have stronger backplane bus drivers, be used in "UMAC" pack configurations.)

The 3U MACRO-CPU can be purchased in two physical configurations, distinguished by part number prefix:

- **300-602804-10x** provides the 3U MACRO-CPU board without a front plate. This configuration is recommended for "stack" assemblies.
- **3R0-602804-10x** provides the 3U MACRO-CPU board with a front plate. This configuration is recommended for "UMAC" rack assemblies. The top and bottom plates are provided with the ACC-Px rack.

There are a few options available for the MACRO CPU board.

One of the Options A or C must be present on a MACRO CPU board to provide the actual MACRO ring interface circuitry; both may be present:

Option A provides an SC-style fiber-optic transceiver to connect into the MACRO ring. Its main component is the U73 transceiver.

Option C provides RJ-45 electrical input and output connectors for the MACRO ring. Its main components are J14 and J17.

Option 10 permits a specified revision of the MACRO Station firmware to be installed in the flash memory in the card. Without this option, the latest released revision is installed. A label on the flash memory IC indicates the firmware revision installed at the factory (but not necessarily which revision is presently installed in the IC). The presently installed revision can be ascertained by using the **`MSVER{node #}`** command.

3U MACRO CPU BOARD HARDWARE SETUP

The hardware setup of the 3U MACRO CPU Board consists of the setting of 2 rotary switches, the setting of several E-point jumpers on each board, followed by power supply and signal connections.

Note

E-Point Jumper numbers are shown in white ink on the legend of each board. Pin numbers for each number can be determined either from the legend on the component side on the board, or by looking at the solder side of the board, where pin 1 has a square solder pad.

3U MACRO CPU Board Jumper & Switch Setup

The MACRO Station has two 16-way rotary switches on the MACRO CPU board that establish the station's basic configuration on the MACRO ring.

SW1 Rotary Switch Setting: SW1 establishes how many servo nodes, and which servo nodes, will be used on the MACRO station. It also establishes the mapping of MACRO node numbers to MACRO Station channel numbers. This mapping information will be important in establishing the software setup.

The following table shows possible MACRO Station axis configurations and the appropriate settings of SW1:

# of Servo Chan's & Nodes Used	Which MACRO Servo Nodes Used	Stack Axis Boards Used	Backplane (UMAC) Axis Boards Used	SW1 Setting
2	0, 1	1x ACC-1E	--	8
2	4, 5	1x ACC-1E	--	9
2	8, 9	1x ACC-1E	--	10 ($A)
2	12, 13	1x ACC-1E	--	11 ($B)
2	0, 1	1x ACC-2E*	1x ACC-24E2x or 51E	2
2	4, 5	1x ACC-2E*	1x ACC-24E2x or 51E	3
2	8, 9	1x ACC-2E*	1x ACC-24E2x or 51E	4
2	12, 13	1x ACC-2E*	1x ACC-24E2x or 51E	5
4	0, 1, 4, 5	1x ACC-2E	1x ACC-24E2x w/ Opt 1x or 1x ACC-51E w/ Opt 1	0
4	8, 9, 12, 13	1x ACC-2E	1x ACC-24E2x w/ Opt 1x or 1x ACC-51E w/ Opt 1	1
6	0, 1, 4, 5, 8, 9	1x ACC-1E, 1x ACC-2E	1x ACC-24E2x w/ Opt 1x or 1x ACC-51E w/ Opt 1; plus 1x ACC-24E2x or 51E	12 ($C)
6	0, 1, 4, 5, 8, 9	2x ACC-2E*	1x ACC-24E2x w/ Opt 1x or 1x ACC-51E w/ Opt 1; plus 1x ACC-24E2x or 51E	6
8	0, 1, 4, 5, 8, 9, 12, 13	2x ACC-2E	2x ACC-24E2x w/ Opt 1x / ACC-51E w/ Opt 1	7

More detailed information on the SW1 settings is presented in the Jumper/Switch description in the back of this manual.

SW2 Rotary Switch Setting: SW2 establishes the number of the master IC to which the MACRO station will respond. The values of 0 to 15 correspond to Master numbers 0 to 15, respectively. For a non-Turbo PMAC2 master, this value must match the master number value in the first hexadecimal digit of PMAC2's I996. For a Turbo PMAC2, this value must match the master number value in the first hexadecimal digit of the Turbo PMAC2's I6840, I6890, I6940, or I6990, for MACRO ICs 0, 1, 2, or 3, respectively, on the Turbo PMAC2. The default switch setting is 0, so the station will respond to Master 0.

Watchdog Timer Enable Jumper: For normal operation of the Compact MACRO Station, jumper E1 should be OFF to enable the watchdog timer (an important safety feature).

Operational Mode Jumper: Jumper E2 should connect pins 2 and 3 to tell the CPU it is in normal operational mode, not in "bootstrap" mode. It should only connect pins 1 and 2 if you desire to load new firmware into the flash IC through the serial port.

Baud Rate Jumper: Jumper E3 must be ON if you are connecting an ACC-8D Option 9 Yaskawa absolute encoder converter to the J7 serial port (most users will connect it to the JTHW port instead). This sets the baud rate to 9600. If E3 is OFF, the baud rate is 38400.

Power Supply Check Jumper: Remove jumper E4 if you are not bringing a +/-12V to +/-15V supply into the Compact MACRO Station itself (5V only). If you are bringing these analog circuit supplies into the Compact MACRO Station, it is best to have jumper E4 on, so that the servo outputs are disabled if either of the analog supplies is lost.

MACRO Input Select Jumper: Because the MACRO CPU board can potentially accept MACRO ring input from either the RJ-45 electrical input or the fiber input, you must select which input is used (even if only one of the ring interface options is present). Jumper E40 must be ON to use the fiber input; it must be OFF to use the electrical input. (If both interface options A and C are present, either ring output may be used, regardless of the setting of E40.)

MACRO Signal-Loss Detect Jumper: Jumper E5 (board revisions –105 and newer only) should connect pins 1 and 2 so that the MACRO receiver's (fiber or electrical) loss-of-signal detect is reported automatically as a byte "violation" error. Older revisions (-104 and before) of the board could not use the receiver's signal-loss detect as a "violation" error (relying on higher-level detection schemes), and connecting pins 2 and 3 makes operation of the new revision completely compatible with the old. This is not recommended.

MACRO CPU Board Connections

The connection of Compact MACRO Station to other stations on the MACRO ring is achieved by connecting the output connector of the Compact MACRO Station to the input connector of the next station, and by connecting the output connector of the previous station to the input connector of the Compact MACRO Station. There must be a completely connected ring, with all stations powered up, for any communications to occur on the ring.

Optical Fiber Ring Connection: The U73 integrated fiber optic transceiver is used for both the optical fiber input and the optical fiber output connections to the MACRO ring. With the component side of the board up, and the opening facing you, the input socket is on the right, and the output socket is on the left (these are marked on the component).

RJ45 Electrical Ring Connection: The J14 connector is used for the input from the previous station on the MACRO ring if electrical connection is used, and the J17 connector is used for the output to the next station on the MACRO ring.

Multiplexer Port: The J6 26-pin header is used to connect to multiplexer port accessories such as the ACC-8D Opt 7 resolver-to-digital converter board and the ACC-8D Opt. 9 Yaskawa absolute encoder interface board. This port can be used alternately to provide 8 inputs and 8 outputs (non-multiplexed) at TTL levels.

Backplane "UBUS" Expansion Port: The P2 96-pin DIN header is used to connect to expansion port accessories such as the ACC-9E, 10E, 11E, 12E, and 14E I/O boards, or the ACC-24E2x axis boards, through an

ACC-Ux "UBUS" backplane board. It can also be used to bring in 5V power, and optionally +/-15V power, from a backplane or breakout board, to the entire MACRO Station.

Note

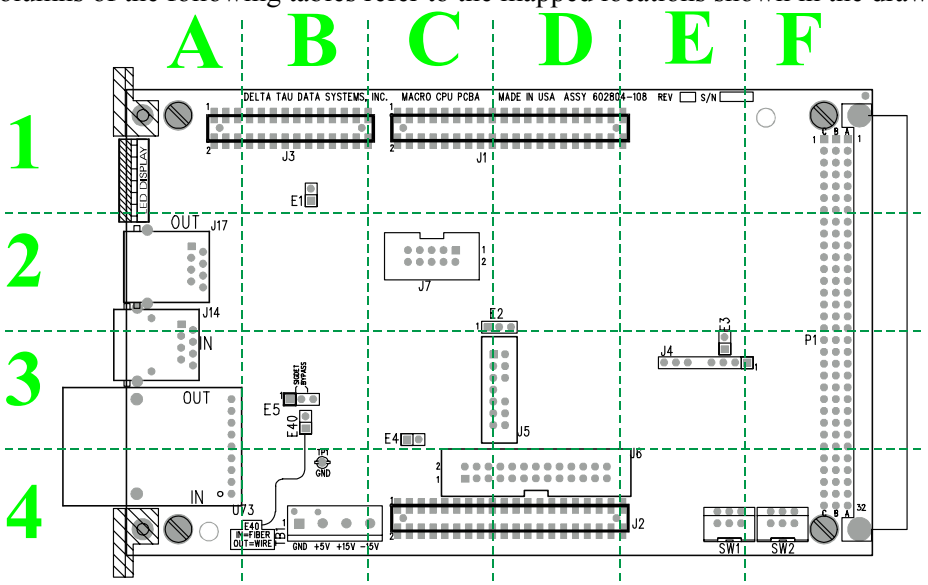
When interfacing to accessory boards across the UBUS backplane, it is strongly recommended to use a new revision (-105 or higher) of the MACRO CPU board, and an ACC-Ux backplane board (not an older ACC-Jx backplane board). The newer revision MACRO CPU boards have stronger bus driver ICs, but they do not work well with the termination of the ACC-Jx backplane boards.

Power Terminal Block: The TB1 4-point terminal block can be used to bring in 5V power, and optionally +/-15V power, to the entire MACRO Station. In a UMAC (pack) configuration, the power is more likely to be brought in through the backplane.

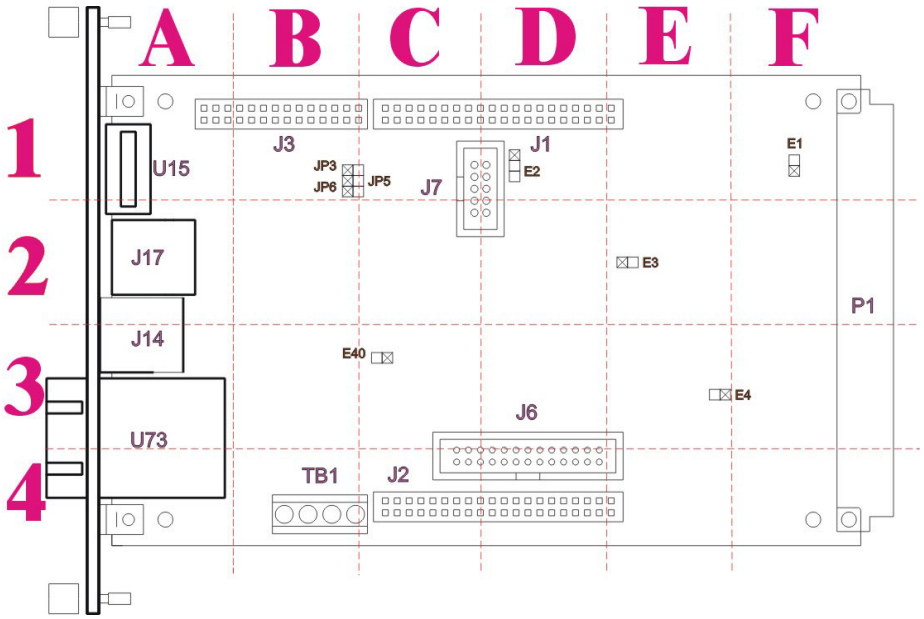
3U MACRO-CPU JUMPER AND SWITCH CONFIGURATIONS

3U MACRO-CPU Card Layout

The "Location" columns of the following tables refer to the mapped locations shown in the drawings below:



REV-105 and Later Revisions



REV-104 and Earlier Revisions

Note:

Pin 1 of an E-point is masked by an "X" in white ink on the composite side, and by a square solder pad on the solder side.

E1: Watchdog Timer Disable

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
B-1	**F-1**	**2-PIN**	Remove jumper to enable Watchdog Timer. Jump pins 1 and 2 to disable Watchdog Timer (for test purposes only)	not jumpered

E2: CPU Mode Operation

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
D-2	**D-1**	**3-PIN**	Jump pins 1 and 2 for firmware download through serial port. Jump pins 2 and 3 for normal operation.	Pin 2-3

E3: Serial Port Baud Rate

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
E-3	**E-2**	**2-PIN**	Jump pins 1 and 2 for 9600-baud serial port operation. (Required for Yaskawa interface). Remove jumper for 38400-baud serial port operation.	not jumpered

E4: Power Supply-Loss Control (±15Vdc Supply Monitor)

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
E-3	**E-2**	**2-PIN**	Jump pins 1 and 2 to disable servo outputs on loss of +5V, +15V, or –15V power supply. Remove this jumper to monitor +5Vdc power supply only. ±15V supply monitoring is not usually required for applications without DACs or A-D converters.	not jumpered

E5: MACRO Received Signal Detect/Bypass Mode (rev -105 and 106 only). Does not exist on rev 107 and later models.

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
B-3		**3-PIN**	Jump pins 1 and 2 to access the receiver's signal detect operation. Jump pins 2 and 3 to bypass the receiver's signal detect operation. This jumper does not exist on MACRO-CPU versions -104 and earlier.	Pin 1-2

E40: MACRO Input (Fiber/Wired) Selector

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
B-3	**C-3**	**2-PIN**	Remove jumper to select MACRO wired (RJ45) input from J14. Jump pins 1 and 2 to select MACRO fiber optic input from U73.	Jumpered (Option A) Not jumpered (Option C)

JP3: MACRO Loop back Test Select For Copper Only (rev -104 and earlier)

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
	B-1	**2-PIN**	Remove jumper to select loop back in the copper interface of MACRO communications (for test purposes only). Jump pins 1 and 2 for normal copper MACRO communications. This jumper does not exist on MACRO-CPU versions -105 and greater.	jumpered

JP4: Reserved for Future Use

JP5-JP6: MACRO Copper EQ Select (rev -104 and earlier)

Rev -105 and Later Location	Rev -104 and Earlier Location	Jumper Type	Description	Default
	B-1	**2-PIN**	These jumpers are used to select different modes of equalization when copper-based communications are used. When not jumpered, adaptive equalization is used. JP5 and JP6 are used for manufacturer's testing only. These jumpers do not exist on MACRO-CPU versions -105 and greater.	not jumpered

Switch Configurations

SW1: MACRO Slave Node Configure

SW1 Setting	# of Servo Channels & Nodes Used	MACRO Servo Nodes Specified	Station Channel Nos.	Station Channel Starting Addresses	1st Axis Board Servo IC	2nd Axis Board Servo IC	PMAC2's I996 Value ** (Turbo PMAC2'S I6840, etc.	PMAC2's I1000, I1002 Value (Turbo PMAC2's I70, I71, etc.)
0 (default)	4	0, 1, 4, 5	1, 2, 3, 4	$C000, $C008, $C010, $C018*	4-axis	None	$F8033	$0033
1	4	8, 9, 12, 13	1, 2, 3, 4	$C000, $C008, $C010, $C018*	4-axis	None	$FB300	$3300
2	2	0, 1	1, 2	$C000, $C008*	4-axis	None	$F8003	$0003
3	2	4, 5	3, 4	$C010, $C018*	4-axis	None	$F8030	$0030
4	2	8, 9	1, 2	$C000, $C008*	4-axis	None	$F8300	$0300
5	2	12, 13	3, 4	$C010, $C018*	4-axis	None	$FB000	$3000
6	6	0, 1, 4, 5, 8, 9	1, 2, 3, 4, 5, 6	$C000, $C008, $C010, $C018, $C020, $C028*	4-axis	4-axis	$F8333	$0333
7	8	0, 1, 4, 5, 8, 9, 12, 13	1, 2, 3, 4, 5, 6, 7, 8	$C000, $C008, $C010, $C018, $C020, $C028, $C030, $C038*	4-axis	4-axis	$FB333	$3333
8	2	0, 1	9, 10	$C090, $C098	2-axis	None	$F8003	$0003
9	2	4, 5	9, 10	$C090, $C098	2-axis	None	$F8030	$0030
10	2	8, 9	9, 10	$C090, $C098	2-axis	None	$F8300	$0300
11	2	12. 13	9, 10	$C090, $C098	2-axis	None	$FB000	$3000
12	6	0, 1, 4, 5, 8, 9	1, 2, 3, 4, 9, 10	$C000, $C008. $C010, $C018,* $C090, $C098	4-axis	2-axis	$FB333	$0333
13	0 (I/O only)	None	None	None	None	None	$F8000	$0000
14	(Reserved	For	Future	Use)				
15 ***	0	11	-	-	-	-	$F8800	-

* These addresses are for stack axis boards. Add $40 to these addresses for backplane axis boards.

** Other bits of this I-variable may also be set to enable I/O nodes or other slave stations it is commanding

*** A setting of 15 forces the station to use its factory default I-variables on power-up/reset.

SW2: MACRO Master Number Select

0: Commanded from Master IC # 0
1: Commanded from Master IC # 1
…
F: Commanded from Master IC # F (15)

Connector Summary

J1: ☼	JEXP_A: for interboard connection
J2: ☼	JEXP_B: for interboard connection
J3: ☼	JEXP_C: for interboard connection
J4: ☼	JISP: Factory configuration header
J5: ☼	JTAG/OnCE: Factory troubleshoot header
J6:	JTHW: Multiplexer Port Connector
J7:	JRS232: Serial Port Connector
J14, J17:	RJ45: MACRO Copper I/O (OPT C)
P1:	JEXP: Backplane Expansion Port Connector
TB1:	JPWR: 4-Pin Terminal Block
U73:	MACRO Fiber Optic Connector (OPT A)

☼ These connectors are not typically designated as end-user interfaces. The pinouts are not included in this hardware reference manual. Consult the factory if pinout information is needed.

MACRO STATION CHARACTER DISPLAY

The Compact MACRO Station has a single hexadecimal character display on the CPU/Interface Board that provides useful information as to the status of the station. The display can show the following values:

Value	Meaning
(Blank)	Ring not active
0-8	Operation OK; value is # of motors enabled
9	(reserved for future use)
A	Amplifier fault
B	Ring break fault
C	CPU failure fault
D	Ring data error
E	Loss-of-encoder fault
F	Other failure

HARDWARE RE-INITIALIZATION

MACRO hardware reinitialization to factory defaults is enabled when the SW1 setting is set to 15 or F (hexidecimal) and the power is cycled at the MACRO Station. The only time the user would want to use a hardware reinitialization to factory defaults with the MACRO Station would be if the MACRO Station always powers up with a watchdog (typically if the ring clock at the Ultralite is different than the ring clock at the MACRO Station). **Node 11** will be the only MACRO Station node enabled. Therefore the user will have to enable node 11 of the MACRO IC at the Ultralite to communicate to the MACRO Station.

Ultralite Example: Servo nodes 0,1,4,5 enabled at Ultralite (I996=$0F8033)
(A) The user would have to enable node 11, I996=$0F8833
(B) Then user can reistablish communications with MS11,(MIvar) commands
(C) Issue MS$$$***11 to ensure re-initialization
(D) Issue MSSAVE11 command to save the factory defaults to the Station

Turbo Ultralite Example: Servo nodes 0,1,4,5 enabled at Ultralite (I6841=$0F8033)
(A) The user would have to enable node 11, I996=$0F8833
(B) Then user can reistablish communications with MS11,(MIvar) commands
(C) Issue MS$$$***11 to ensure re-initialization
(D) Issue MSSAVE11 command to save the factory defaults to the Station

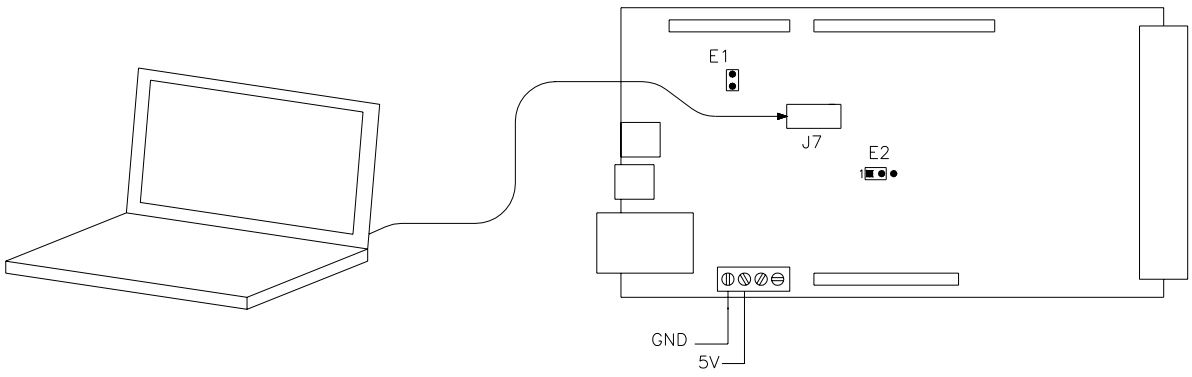
FIRMWARE UPDATES

Downloading new firmware to the MACRO Station is a simple process once the MACRO board is setup properly.
To download new firmware to the MACRO station, the user must have the following items:
5V power supply
2 jumpers
DB9 female to 10 pin header (any cable used for PMAC RS232 communications)
PC at the DOS prompt.
New firmware and necessary downloading batch files

Make sure to power down the MACRO Station
To download the software to the MACRO station, the user will first jumper the following E2 (1-2) and E1 (1-2).
Wire the 5V power to the appropriate terminal on the MACRO station or plug into 3U Rack.
Place the 10 pin header cable to the serial connection on the MACRO-station and place the other end to the COM1 port on the PC (the batch files were written for COM1 but could be modified if necessary).
Goto the DOS prompt and create a directory called firmware and station (as an example).
C:\firmware\station
a:\copy *.* c:\firmware\station
Go back to the c drive and type the following command
c:\firmware\station\mcdwnld
The firmware will be down loaded to the MACRO station. Easy!

The PMAC Executive Software will soon have the capability of downloading the MACRO Station firmware in the Windows Operating Environment.
(5) Place jumper E2 back to pins 2-3 and remove E1 jumper

Please call the factory if you have any questions.

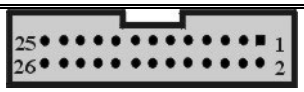


3U MACRO-CPU BOARD CONNECTOR PIN-OUTS

The schematic circuits shown in this section are for interface reference only. Subtle differences may exist between the circuits shown here and the actual hardware used.

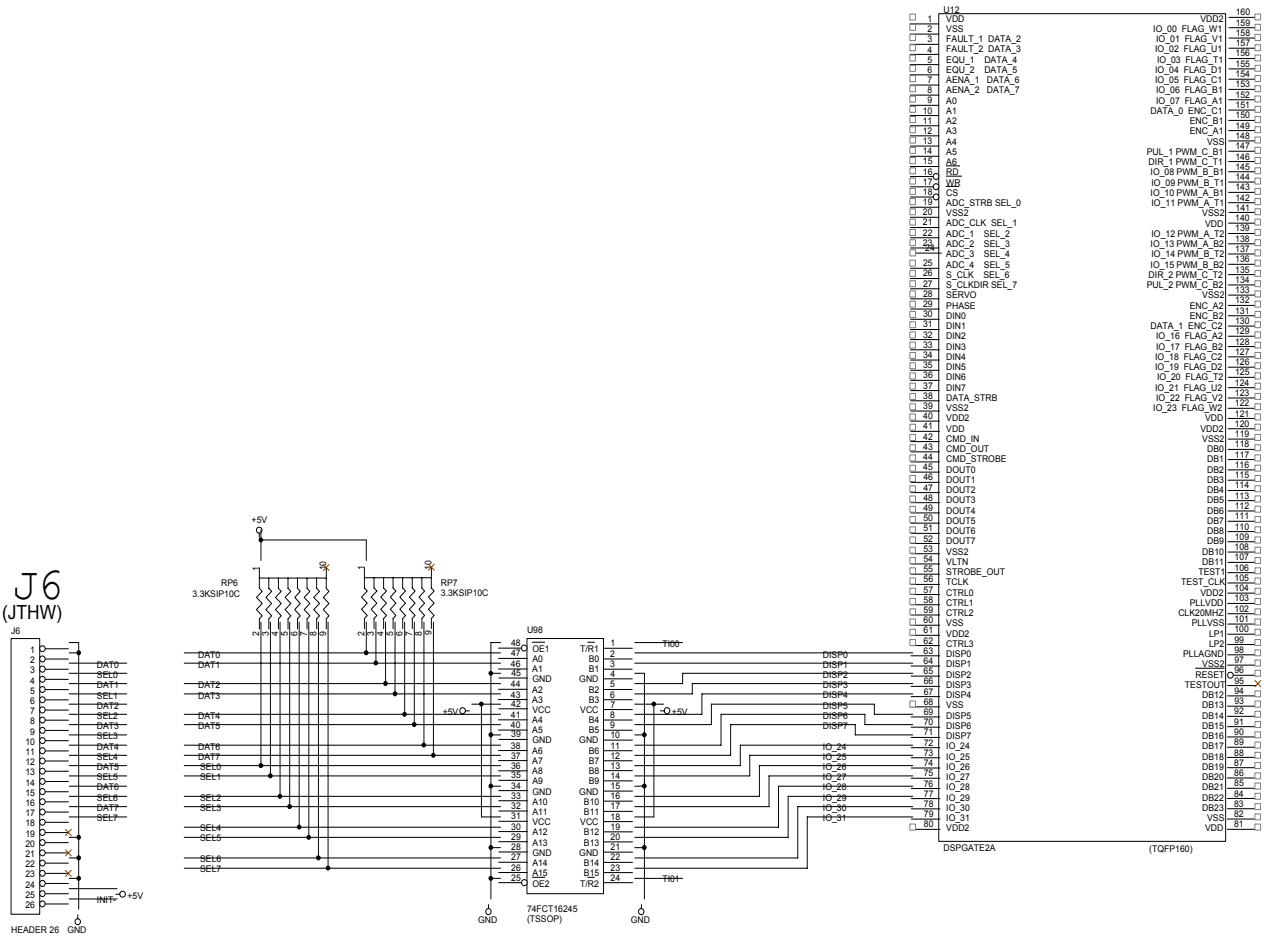
J6: (JTHW) Multiplexer Port Connector

(26-pin Header at Location D-3)



Front View

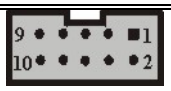
Pin #	Symbol	Function	Description	Notes
1	GND	Common	PMAC Common	
2	GND	Common	PMAC Common	
3	DAT0	In/Out	Data Byte Bit 0	Must be IN for MUX
4	SEL0	In/Out	Select Byte Bit 0	Must be OUT for MUX
5	DAT1	In/Out	Data Byte Bit 1	Must be IN for MUX
6	SEL1	In/Out	Select Byte Bit 1	Must be OUT for MUX
7	DAT2	In/Out	Data Byte Bit 2	Must be IN for MUX
8	SEL2	In/Out	Select Byte Bit 2	Must be OUT for MUX
9	DAT3	In/Out	Data Byte Bit 3	Must be IN for MUX
10	SEL3	In/Out	Select Byte Bit 3	Must be OUT for MUX
11	DAT4	In/Out	Data Byte Bit 4	Must be IN for MUX
12	SEL4	In/Out	Select Byte Bit 4	Must be OUT for MUX
13	DAT5	In/Out	Data Byte Bit 5	Must be IN for MUX
14	SEL5	In/Out	Select Byte Bit 5	Must be OUT for MUX
15	DAT6	In/Out	Data Byte Bit 6	Must be IN for MUX
16	SEL6	In/Out	Select Byte Bit 6	Must be OUT for MUX
17	DAT7	In/Out	Data Byte Bit 7	Must be IN for MUX
18	SEL7	In/Out	Select Byte Bit 7	Must be OUT for MUX
19	N.C.	N.C	No Connection	
20	GND	Common	PMAC Common	
21	BRLD/	Output	Buffer Request	Low is “BUFFER REQ.”
22	GND	Common	PMAC Common	
23	IPLD/	Output	In Position	Low is “IN POSITION”
24	GND	Common	PMAC Common	
25	+5V	Output	+5VDC Supply	Power Supply OUT
26	INIT/	Input	PMAC RESET	Low is “RESET”



Circuitry For J6- JTHW Interface

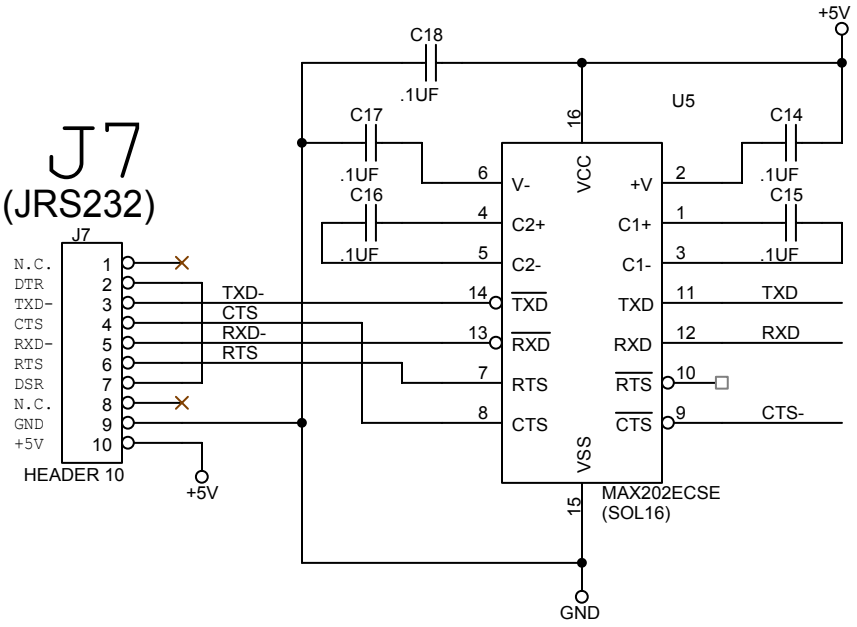
J7: (JRS232) Serial Port Connector

(10-pin Header at Location C-1)



Front View

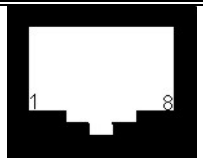
Pin #	Symbol	Function	Description	Notes
1	N.C.		No connection	
2	DTR	BIDIRECT	Data Terminal Ready	Just tied to “DSR”
3	TXD/	OUTPUT	Send Data	Transmit data to host
4	CTS	INPUT	Clear to Send	Host Ready bit
5	RXD/	INPUT	Receive Data	Receive data from host
6	RTS	OUTPUT	Request to Send	PMAC Ready bit
7	DSR	BIDIRECT	Data Set Ready	Just tied to “DTR”
8	N.C.	OUTPUT	No Connection	
9	GND	COMMON	PMAC Common	
10	+5V	OUTPUT	+5VDC Supply	Power supply out



Circuitry for J7- JRS232 Interface

J14, J17: MACRO COPPER I/O (OPT C)

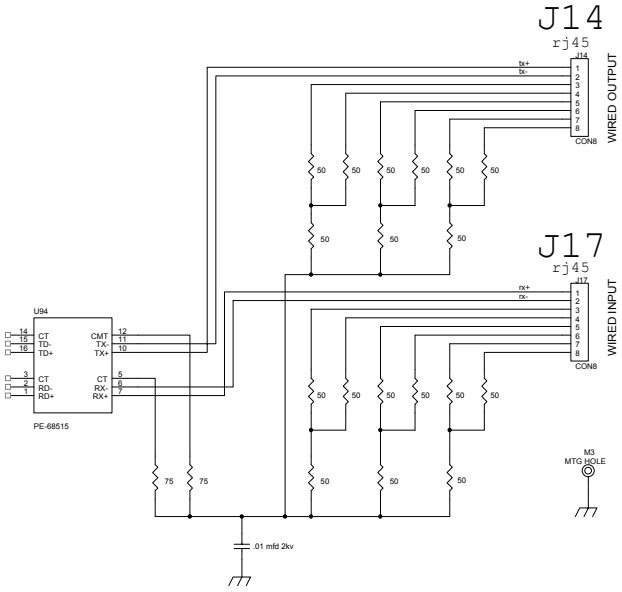
(8 pin RJ45)



Front View

Pin #	Symbol	Function	Description	Notes
1	DATA+	Data +	Differential MACRO Signal.	J17: DATA+ input. J14: DATA+ output.
2	DATA-	Data -	Differential MACRO Signal	J17: DATA- input. J14: DATA- output.
3	unused		Unused terminated pin	See schematic below.
4	unused		Unused terminated pin	See schematic below.
5	unused		Unused terminated pin	See schematic below.
6	unused		Unused terminated pin	See schematic below.
7	unused		Unused terminated pin	See schematic below.
8	unused		Unused terminated pin	See schematic below.

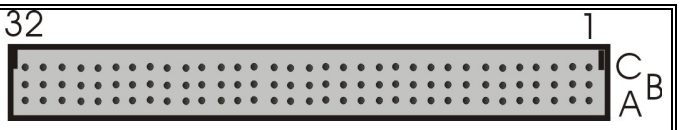
The cable used for MACRO wired connections is CAT5 verified straight-through 8 conductor.



Circuitry for J14 and J17- Copper MACRO I/O

P1: UBUS Interface Connector

(96 pin EURO-Connector at F-1, 2, 3, 4)



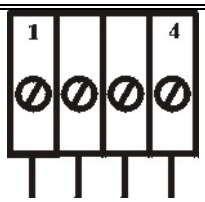
Front View on MACRO-CPU Card

Pin #	Row A	Row B	Row C
1	+5Vdc	+5Vdc	+5Vdc
2	GND	GND	GND
3	BD01	DAT0	BD00
4	BD03	SEL0	BD02
5	BD05	DAT1	BD04
6	BD07	SEL1	BD06
7	BD09	DAT2	BD08
8	BD11	SEL2	BD10
9	BD13	DAT3	BD12
10	BD15	SEL3	BD14
11	BD17	DAT4	BD16
12	BD19	SEL4	BD18
13	BD21	DAT5	BD20
14	BD23	SEL5	BD22
15	BS1 (GND)	DAT6	BS0 (GND)
16	BA01	SEL6	BA00
17	BA03	DAT7	BA02
18	BX/Y	SEL7	BA04 (n.c.)
19	CS3-	BA06 (n.c.)	CS2-
20	BA05 (CS7-)	BA07 (n.c.)	CS4- (CS6-)
21	CS12-	BA08 (n.c.)	CS10-
22	CS16-	BA09 (n.c.)	CS14-
23	BA13 (n.c.)	BA10 (n.c.)	BA12 (n.c.)
24	BRD-	BA11 (n.c.)	BWR-
25	BS3 (GND)	MEMCS0- (n.c.)	BS2 (GND)
26	n.c.	MEMCS1- (n.c.)	RESET
27	PHASE+	n.c.	SERVO+
28	PHASE- (n.c.)	n.c.	SERVO- (n.c.)
29	GND	n.c.	GND
30	-15Vdc	PWRGUD (n.c.)	+15Vdc
31	GND	GND	GND
32	+5Vdc	+5Vdc	+5Vdc

1. Refer to the UBUS Specification for detailed signal descriptions. This interface is *NOT* VME bus compatible.
2. Items shown in parentheses represent pin descriptions for -104 and earlier revision MACRO-CPU boards.

TB1: (JPWR) 4-Pin Terminal Block

(Location B-4)



Pin #	Symbol	Function	Description	Notes
1	GND	Common	Reference Voltage	
2	+5V	Input	Positive Supply Voltage	Supplies all PMAC digital circuits
3	+15V	Input	Positive Supply Voltage	+12V to +15V; used for on-board analog
4	-15V	Input	Negative Supply Voltage	-12 to –15V; used for on-board analog

U73: MACRO Fiber Optic Connector (OPT A)

(2 Socket SC-Style)

Front View

Pin #	Symbol	Function	Description	Notes
1	RX	Fiber Input	MACRO Ring Receiver	
2	TX	Fiber Output	MACRO Ring Transmitter	

A. The fiber optic version of MACRO uses 62.5/125 multi-mode glass fiber optic cable terminated in an SC-style connector. The optical wavelength is 1,300nm.
B. It is possible to "adapt" wire to fiber operation when using OPT A & C on the same MACRO-CPU board.

U MACRO-CPU HARDWARE MEMORY MAP

The values in this table represent the hardware locations associated with register-based transactions that occur in the 3U MACRO-CPU.

Reference	ADDR (hex)	Description
CS00-	$FFC0	Stack I/O select #1
CS02-	$FFC8	Stack I/O select #2
CS04-	$FFD0	Stack I/O select #3
CS06-	$FFD8	Stack I/O select #4
CS0-	$C000	Stack axis 1-4 select
CS1-	$C020	Stack axis 5-8 select
CS2-	$C040	UBUS backplane axis 1-8 select
CS3-	$C060	UBUS backplane axis 5-8 select
CS4-	$C080	On-board DSPGATE2 select
CS4X-	$C0C0	UBUS backplane MACROgate or DSPgate2 select (CS4- on UBUS)
CS10-	$FFE0	UBUS backplane I/O select #1
CS12-	$FFE8	UBUS backplane I/O select #2
CS14-	$FFF0	UBUS backplane I/O select #3
CS16-	$FFF8	UBUS backplane I/O select #4
MEMCS0-	$D000	UBUS hardware I/O field (was DPRCS-)
MEMCS1-	$E000	UBUS hardware I/O field (was VMECS-)

The addressing field size is 16-bits in the 3U MACRO-CPU. The address table above is similar to the PMAC2 product line.

ACCESSORIES

Both the Turbo and the MACRO CPU boards can support either the Stack or the UMAC configuration. The systems are configured modularly with the selection of a series of accessory boards, some appropriate for the Stack, and some appropriate for the UMAC. These accessories are listed here. Each has its own manual for detailed description.

The following table shows 3U products by function:

MACRO CPU Board Options	Board must be ordered with either Option A or Option C.	Option A, fiber-optic connectors	Option C, RJ-45 electrical MACRO connectors
"Stack" Piggyback Accessory Boards	ACC-1E, 2-Axis Interface Stack Board (UMAC MACRO only), 3x0-602810-10x	ACC-2E, 4-Axis Interface Stack Board, 3x0-602805-10x	ACC-3E, 48/96/144 TTL I/O Stack Board, 3x0-602811-10x
	ACC-4E, Isolated 24-In/24-Out Stack Board, 3x0-602872-10x	ACC-6E, 8/16-Channel 12-Bit ADC Stack Board, 3x0-602810-10x	
UMAC Backplane-Mountable Accessory Boards – Axis	ACC-24E2, 2-Axis Digital PWM, 3x0-603397-10x	Option 1D, Additional 2-Axis Digital PWM, 3D1-603397-10x	ACC-24E2A, 2-Axis Analog, 3x0-603398-10x
	Option 1A, Additional 2-Axis Analog, 3A1-603398-10x	ACC-24E2S, 4-Axis Stepper, 3x0-603441-10x	
UMAC Backplane-Mountable Accessory Boards – I/O	ACC-3E1, 48/96/144 I/O, 3x0-603359-10x	ACC-9E, 48 In, 3x0-603283-10x	ACC-10E, Isolated 48-Output Board, 3x0-603299-10x
	ACC-11E, Isolated 24-In/24-Out Board, 3x0-603307-10x	ACC-12E, Isolated 24-In/24-Hi-Power-Out Board, 3x0-603277-10x	ACC-14E, 48 I/O, 3x0-603472-10x
UMAC Backplane-Mountable Accessory Boards – Communication	ACC-55E, (UNET) Universal Field Bus Adapter Network Card, 3x0-603485-10x		
UMAC Backplane-Mountable Accessory Boards – Miscellaneous	ACC-28E, 16-Bit A/D, 3x0-603404-10x	ACC-36E, A/D, D/A Converter, 3x0-603483-10x	ACC-51E, X 4096 Interpolator, 3x0-603438-10x
	ACC-53E, SSI, 3x0-603360-10x	ACC-56E, Extender Card, 300-603401-10x	ACC-57E, Yaskawa or Mitsubishi ABS, Encoder Unit, 3x0-603484-10x
	ACC-58E, R/D Converter, 16 Bit, 3x0-603482-10x		
UBUS Backplane	ACC-U4, UBUS 4-Slot	ACC-U6, UBUS 6-Slot	ACC-U8, UBUS 8-Slot

Boards	Backplane, 300-603462	Backplane, 300-603403-10x	Backplane, 300-603463-10x
	ACC-U10, UBUS 10-Slot Backplane, 300-603464-10x	ACC-U12, UBUS 12-Slot Backplane, 300-603465-10x	ACC-U14, UBUS 14-Slot Backplane, 300-603466-10x
	ACC-U16, UBUS 16-Slot Backplane, 300-603471-10x	ACC-U18, UBUS 18-Slot Backplane, 300-603491-10x	
Amplifiers – Analog ±10VDC Input (Brush Motors)	4-Axis Analog ± 10V Input Linear Amplifier, 24VDC, 0.5/1A, 300-603489-10x	4-Axis Analog ± 10V Input PWM Amplifier, 48VDC, 2/4A, 300-603443-10x	4-Axis Analog ± 10V Input PWM Amplifier, 70VDC, 8/12A, 300-603486-10x
	Backplane, Double Analog Amplifier, 300-603470-10x	Backplane, Single Analog Amplifier, 300-603490-10x	
Amplifiers – Digital PWM Input (brushless)	2-Axis Digital PWM Amplifier, 360VDC, 4/8A, 400-603391-10x	2-Axis Digital PWM/Macro Amplifier, 360VDC, 8/16A, 400-603392-10x	Single Axis Digital PWM/Macro Amplifier, 360VDC, 8/16A, 401-603391-10x
	Single-Axis Digital PWM Amplifier, 360VDC, 8/16A, 401-603492-10x	Power Supply for 3U Digital PWM Amplifiers, 400-603428-10x	Backplane, Digital PWM, 300-603435-10x
Power Supplies – DC Input	ACC-F, 3U DC to DC Converter,10A, 30F-603216-OPT		
Power Supplies – AC Input	ACC-E, 3U AC Power Supply, 8A, 30E-603269-OPT	ACC-E1, 3U AC Power Supply, 14A, 31E-603269-OPT	ACC-E2, AC Power Supply, 20A, 32E-603468-OPT
UMAC Chassis Assemblies (Rack)	3U Rack, 10-1/2 Slot (42T) 542-602932-10x	3U Rack, 15-3/4 Slot (63T) 563-602932-10x	3U Rack, 21 Slot (84T) 584-602932-10x
	3U Rack, Variable Width per Customer Requirements (custom design) , 500-602932-10x		
Hybrid Stack/Pack Accessories (Legacy Systems Only)	ACC-8DE, 2-Axis 3U Analog-Output Breakout Board, 3x0-603215-10x	ACC-8FE, 2-Axis 3U Digital-Output Breakout Board, 3x0-603176-10x	ACC-13, Encoder Terminal Block Board, 300-603365-10x
	ACC13A, Flag Terminal Block Board, 300-603366-10x	ACC-13B, Amplifier Terminal Block Board, 300-603367-10x	ACC-15E, Isolated 12-In/12-Out Opto22 Driver & Breakout Board, 300-603488-10x